General Information

Site Name and Location:	Former Cowboy Cleaners Broomfield, Colorado, United States
Description: Historical activity that resulted in contamination.	A site investigation revealed the presence of soil and groundwater contamination, with a groundwater plume covering approximately 1.5 acres. The remediation was handled under the Colorado Voluntary Cleanup Program. The plume occupied portions of five separately owned properties and crossed a street. Small portions of the plume also flowed beneath a retail building and a residence.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).	**Contaminant**	**Conc in GW**	**Conc. in Soil**
	Tetrachloroethene (PCE)	1,900 : g/L	

Other Contaminants Present: Indicates what other contaminants were found on-site	
Deepest Significant Groundwater Contamination:	

Plume Size: 1.5 acres

Site Hydrology:

Depth to Groundwater: 25 ft bgs

Lithology and Subsurface Geology: Stiff clay to silty to sometimes sandy clay at 3 ft bgs and a sandy clay layer at 8 ft. bgs.

Conductivity:

Gradient:

Media:

Media: DNAPL
Groundwater
Soil

Remediation Scenario:

Cleanup Goals: Cleanup goals were not identified.

Technologies:

Technologies Used: In Situ:
Chemical Oxidation

Other technologies used:

Why the technology was selected:

Date implemented: September 2001

Final remediation design: system of 12 nested injectors was installed in the source area. Semi-permanent injectors manufactured using 1-inch PVC screen and riser were installed to allow the controlled injection of permanganate reagent directly into the area of contamination. Each injector was installed with a sand pack to just above the screen, and grouted to the surface. Upon setting of the grout, a charge of permanganate was pressure injected into each injector. A 10% (by weight) solution of permanganate was introduced into each injector, with as much volume as each injector would take, to a maximum of 100 gallons. The injectors were then connected to each other in ranks, and to a head tank by PVC piping. The gravity feeding to all of the injectors on a continuous basis was then started. Up to 300 gallons per day of 1-2% solution were fed into the system during remediation. Most of the injectors were completely above the water table to avoid drainage of reagent directly into groundwater without extensive soil contact. To control PCE that was mobilized into groundwater from the soil source area, a line of injectors was installed dowm stream. These injectors were operated at very low volumes and controlled based on the results of a monitoring well immediate downgradient

Results and Next Steps:

Results to date: In the source area, PCE concentration started at 1,900 : g/L. One month into the remediation process, PCE concentration had dropped to 926 : g/L and contunue to decrease further to 284 : g/L three monthe after initiation of the remedy. Post-remediation PCE concentration, monitored 8 months later, was found to be 48 : g/L. Downgradient PCE concentrations decreased from 40 : g/L to 15 : g/L within a year.

Next Steps: In February 2003, the State of Colorado issued a No Action Determination Approval, stating that the property could be used for commercial purposes, and did not pose an unacceptable risk to human health and the environment.

Costs:

Cost for Assessment:

Cost to Design and Implement:

Cost for Operation and Maintenance:

Total Costs for Cleanup: This was a voluntary cleanup action and cost information was not available.

Lessons Learned:

Lessons Learned:

Contacts:

Principal Point of Contact:

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Site Specific References:

Site Specific References:

Viellenave,J.H., et.al., "Using Risk Based Cleanup goals for an In-Situ Chemical Oxidation of PCE in Vadose Zone Soils Under a Voluntary Cleanup Program." Paper presented at IPEC 2002. On-Line address: http://ipec.utulsa.edu/Ipec/Conf2002/tech_sessions.html.

Images:

Images of Site:

Profile last updated on Jan 25, 2005

General Information

Site Name and Location:	Niles Finest Cleaners, Site # 1388 Niles, Illinois, United States
Description: Historical activity that resulted in contamination.	The drycleaner occupies a 1,200-ft2 area within the 9.89-acre Sportmart Plaza strip mall area (The building size is 120,831 ft2). The mall consists of 4 single story buildings and was built from 1957 to 1994. The drycleaning operation has been active for about 20 years. PCE is believed to be the only solvent to have been used at the drycleaning facility. There was a LUST incident with 10,000 gallon heating oil tank, but a No Further Remediation (NFR) Letter was issued in November 1992 for this incident. An alley separates the site from an office building and multi-family residential dwellings. Other areas surrounding the property are primarily used for commercial purposes.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).	**Contaminant**	**Conc in GW**	**Conc. in Soil**
	1,1,1-Trichloroethane		5.61 mg/kg
	1,1-Dichloroethene		3.5 mg/kg
	Tetrachloroethene (PCE)	1 mg/L/kg	1,300 mg
	trans-1,2-Dichloroethene		0.865 mg/kg
	Trichloroethene (TCE)	0.015 mg/L	18 mg/kg
	Vinyl Chloride		2.84 mg/kg

Other Contaminants Present: Indicates what other contaminants were found on-site	Soil: chromium, 0.0015 mg/L

Deepest Significant Groundwater Contamination: not available

Plume Size: N/A

Site Hydrology:

Depth to Groundwater: Encountered at avg. depth of 3.74 ft in monitoring wells (no obvious groundwater table encountered during soil sampling)

Lithology and Subsurface Geology: 0.101 ft/day

Conductivity: 0.034 ft/ft

Gradient:

Media:

Media: Groundwater
Soil

Remediation Scenario:

Cleanup Goals: Site-Specific -- Groundwater: No Remediation is required Contaminations found in the groundwater were below the groundwater remediation objectives (GROs) Soil: 704.1 mg/kg (PCE) Other contaminants found in soil were below the soil remediation objectives (SROs)

Technologies:

Technologies Used: In Situ:
Chemical Oxidation

Other technologies used:

Why the technology was selected: Originally it was thought that 1. the plume area was less than 200 ft2 with depth of about 10 ft at the most. 2. the majority of contamination was trapped in the sandy layer less than 12-15 ft bgs. 3. about 2 percent of foc can be overcome by relatively high concentration of chemical oxidant. 4. NaMnO4 would have strong enough penetrating power even in clay area by setting the injection points close to each other (e.g. about 2-3 ft apart).

Date implemented: May 2004

Final remediation design: A 10 percent (by weight) of NaMnO4 solution was injected into the surface of the 200-ft2 area on a 24-point grid pattern. 15-19 gallons of the NaMnO4 were injected at each injection point.

Results and Next Steps:

Results to date: Post injection samplings, including groundwater sampling, were conducted at 30- and 60-day intervals following the completion of the initial injection to measure the effectiveness of chemical oxidation with the NaMnO4.

Groundwater: The results of post injection samplings indicate that one of the MWs showed an increase in PCE contamination (from 26 : g/L right before injection to 56 : g/L 30 days after injection, and to 150 : g/L 60 days after injection). The increase of PCE in groundwater after injection was likely caused by a loss of buffering capability in soil because of destruction of natural organic matter by NaMnO4. In other words, NaMnO4, which was supposed to oxidize the PCE contamination in soil, also destroyed the natural organic matter in soil that had been trapping the PCE contamination.

Soil: Based on the concentration and volume of NaMnO4 injected and the close proximity of the injection grids, NaMnO4 should have remediated (i.e. oxidized) the PCE contamination in soil. Although the 30-day post-injection sampling showed a reduction of PCE contamination in soil, however, the 60-day post-injection sampling showed much higher PCE concentration (e.g. 2,000 mg/L and 2,800 mg/L) in the vicinity of the original hot-spot area.

Next Steps: Although the rebound of groundwater contamination can be dealt with by performing additional NaMnO4 injections, the Illinois Fund Administrator and the consultant agreed to abandon the chemical oxidation method with NaMnO4. Based on the post-injection samplings, the recalcitrant nature of PCE contamination in soil is expected to persist for the following reasons:

1. The delivery of chemical oxidant (i.e. NaMnO4) does NOT seem to be efficient in soil.
2. It appears that NaMnO4 is following preferential pathways (sand or minor gravel layers) in the soil, which prevents it from reaching the target area with high PCE contamination.
3. It is possible that more PCE can be released to the groundwater if more of the natural organic matter in soil is destroyed.

Therefore, it has been proposed that about 145 tons (e.g. area of 15 ft x 25 ft with 8- 12 ft of depth) of contaminated soil be removed via excavation.

Costs:

Cost for Assessment: $18,856.71

Cost to Design and Implement: $32, 285.00 (post injection sampling)

Cost for Operation and Maintenance:

Total Costs for Cleanup:

Lessons Learned:

Lessons Learned:

1. Remediation via chemical oxidation especially with permanganate in the tight clay environment is difficult.
2. When utilizing chemical oxidation, rebound or increase of chlorinated solvents in groundwater should be carefully monitored, even where contamination in soil was the only initial concern.

Contacts:

Principal Point of Contact:

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Site Specific References:

Site Specific References:

Images:

Images of Site:

Profile last updated on Mar 17, 2005

General Information

Site Name and Location:	Rummel Creek Shopping Center Houston, Texas, United States
Description: Historical activity that resulted in contamination.	The facility is located in a mixed commercial/residential area comprised mainly of strip centers, restaurants, gas stations, and residential developments. A creek bounds the property on two sides. A dry cleaner operated at the site from 1972 - 1977 and again from 1986 - 1997. An active dry cleaner is located across the utility easement. This site has an extensive monitoring network of 19 wells and the groundwater contamination has impacted residential property.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).

Contaminant	Conc in GW	Conc. in Soil
1,1-Dichloroethene	9.7 : g/L	
cis-1,2-Dichloroethene	2600 : g/L	
Tetrachloroethene (PCE)	2200 : g/L	
trans-1,2-Dichloroethene	20 : g/L	
Trichloroethene (TCE)	610 : g/L	
Vinyl Chloride	12 : g/L	

Other Contaminants Present: Indicates what other contaminants were found on-site

Deepest Significant Groundwater Contamination:

Plume Size:

Site Hydrology:

Depth to Groundwater: 18-23 ft bgs

Lithology and Subsurface Geology: The first saturated unit is located at approximately 20 ft. bgs. This unit is identified as a sandy to silty-sand zone terminating at approximately 33 ft. bgs. This unit is unconfined.

Conductivity: measured from 4.2 to 9.2 ft/day

Gradient: 0.0045 ft/ft

Media:

Media: Groundwater

Remediation Scenario:

Cleanup Goals: PCE: 5 : g/L TCE: 5 : g/L cis 1,2-DCE: 70 : g/L Trans 1,2-DCE: 100 : g/L VC: 2 : g/L

Technologies:

Technologies Used:
In Situ:
Bioremediation
Chemical Oxidation
Soil Vapor Extraction
Ex Situ:
Removal

Other technologies used:

Why the technology was selected: In-situ chemical oxidation (ISCO) was selected because it can oxidize DNAPLs, does not require expensive pump systems, can treat area without disturbing aboveground structures, and does not require excavation and disposal of contaminated soils. Potassium permanganate was specifically selected because it has been shown to be effective for chlorinated solvents; it does not react with carbonate and bicarbonate in soil; the reaction is not exothermic; and the reaction is not toxic to microbes in the soil.

Date implemented: 7/17/01

Final remediation design: A 0.5 - 2 % KMnO4 was injected into the perched water bearing zone, about 10-15 ft bgs using direct push technologies. The remediation was completed in a phased approach. Injections occurred four times over a one year period. A total of 837 pounds of KMnO4 was injected, which is equivalent to 9485 gallons of solution. Each phase included both on-site and off-site injections. The infections on site were completed around the three identified source areas on the site at a spacing of 15-20 ft. Off-site injections targeted the dissolved phase plume. Each injection point received injections at two depths: one approximately 5 ft from the bottom of the transmissive zone, and the other five to 10 ft above the first. The solution was injected at a rate of 1-5 gallons/minute, at a pressure of 15-25 psi. In addition to the permanganate injections, enhanced bioremediation was also employed at three source areas using a biological product called Cl-Out, which consists of freeze dried strains of naturally occurring bacteria that provides rapid, aerobic degradation of chlorinated compounds. Dextrose is added to ?activate? the bacteria. These bacteria were injected in Februaru 2003 using a series of temporary injection points. The injection points were spaced 6-25 ft apart. Soil impacts were addressed through excavation along the sanitary sewer line, one of the only parts of the site not covered with asphalt. This unpaved part of the property was accumulating storm water and therefore covered with an impermeable cap. Underneath this cap, an SVE system was installed. The system consisted of a gallery of 6 vertical, 2-inch-diameter PVC wells, 3 feet deep, and 10 feet apart. The areas around the system were filled with pea gravel. The SVE system was operated for 2 months to remove any residual soil contamination in the area.

Results and Next Steps:

Results to date: highest pre-injection concentrations seen at the source wells were 2200 : g/L for PCE and 610 : g/L for TCE. Following the first KMnO4 injection, the concentrations in the source wells ranged from non-detect-79 : g/L for PCE and non-detect-74 : g/L for TCE. The TCE and PCE concentrations were noted to fluctuate across the non-source wells, but the concentrations were generally decreasing. At the downgradient wells, the plumes have remained stable, or had decreased.

Following the Cl-Out injection in February, results in two source wells sampled in December 2003 showed PCE decreasing from 700 : g/L to 43 : g/L, and 130 : g/L to 26 : g/L. TCE in the two source wells decreased from 250 : g/L to 21 : g/L, and 140 : g/L to 8 : g/L.

Next Steps: Monitoring will continue on a quarterly basis. The owner plans to apply for a conditional closure of the site.

Costs:

Cost for Assessment:

Cost to Design and Implement:

Cost for Operation and Maintenance:

Total Costs for Cleanup:

Lessons Learned:

Lessons Learned: 1. Deep drainage ditch may have acted as a pathway for offsite contamination.

Contacts:

Principal Point of Contact:
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Consultant:
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Houston, TX 77068

Site Specific References:

Site Specific References:

Images:

Images of Site:

Profile last updated on Jun 28, 2004

General Information

Site Name and Location:	Springvilla Dry Cleaners Springfield, Oregon, United States
Description: Historical activity that resulted in contamination.	Springvilla Dry Cleaners operated from the 1960s to 2000. Up to eight self-service drycleaning units were reportedly operated at the facility. The last operator reported that self-service drycleaning was discontinued at the facility upon recognition of an abnormally high replacement rate for the drycleaner solvents. The cleaners was located in a strip shopping center attached to a larger building that was used by a large supermarket. The shopping center remains as an active commercial area.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).	**Contaminant**	**Conc in GW**	**Conc. in Soil**
	1,1-Dichloroethene	6.8 : g/L	
	cis-1,2-Dichloroethene	4 : g/L	<5 : g/kg
	Tetrachloroethene (PCE)	7,800 : g/L	130,000 : g/kg
	Trichloroethene (TCE)	48 : g/L	50 : g/kg

Other Contaminants Present: Indicates what other contaminants were found on-site	
Deepest Significant Groundwater Contamination:	50 ft bgs
Plume Size:	Needs further characterization (>500'x500'x60')

Site Hydrology:

Depth to Groundwater: 5 to 13 ft

Lithology and Subsurface Geology: Silt with varying amounts of sand from ground surface to about 10 ft bgs. Dense, relatively clean, graded gravel from 10 ft to at least 100 ft bgs

Conductivity: gravel: 5 to 10 ft/day

Gradient: 0.003 ft/ft

Media:

Media: Groundwater
Soil

Remediation Scenario:

Cleanup Goals: Reduce contaminant mass beneath building to 1) reduce/remove soil source of groundwater contamination, 2) reduce vapor intrusion potential

Technologies:

Technologies Used: In Situ:
Chemical Oxidation
Monitored Natural Attenuation
Ex Situ:
Carbon Adsorption
Removal
Soil Vapor Extraction

Other technologies used: Engineering Control: Active vapor recovery beneath reconstructed building slab with low pressure radon technology vacuum pump

Why the technology was selected: Soil Excavation: Opportunity to access source beneath building with owner removing part of building to allow excavation. On-Site Soil Treatment (SVE): Space and time allowable. Used RCRA Contained-In rule to delist and dispose treated soil at lower cost than RCRA listed waste. Permanganate: Excavation allowed installation of infiltration gallery, coupled with relatively low cost of materials to provide additional treatment of residual soil and source area groundwater contamination near source following soil excavation.

Date implemented: August 31, 2004 - Soil excavation and soil treatment cell construction commenced. October 11, 2004 - sodium permanganate injection.

Final remediation design: 1) Partial/temporary building demolition and shoring for access. 2) Begining 8/31/04 excavated 150 yards3 of contaminated soil from source zone. 3)Constructed on-site treatment cell using SVE with carbon treatment of vapor effluent. 4) Installed deep (infiltration) and shallow (vapor recovery) slotted piping in excavation before and during backfilling. 5) Building partially reconstructed by owner. 6) On 10/11/04 1,100 gallons of 4% sodium permanganate solution injected through lower infiltration piping in source are excavation. 8)Groundwater monitoring ongoing. Injection of electron donor planned for 2005.

Results and Next Steps:

Results to date: 1) Removed approximately 150 yards3 of soil contaminated with high levels of PCE. Soil treatment complete. System dismantled on 1/24/05.
2) Approximately 50% decrease in shallow groundwater PCE concentration seen in monitoring well nearest the treatment area.
3)Evidence of permanganate (manganese dioxide) has been observed at wells >300 ft downgradient of the treatment area.

Next Steps: 1) Continued groundwater monitoring;
2) Evaluating whether to inject additional permanganate or to switch to a biostimulation approach using simple electron donor added to infiltration gallery. Additional injection to infiltration gallery planned for summer or fall 2005.
3) Continued O&M of vapor recovery system.
4) Continued air monitoring as necessary.
5) Continued work with property on risk communication and management.

Costs:

Cost for Assessment: About $130,000, including project administration, site investigation, beneficial use evaluations, groundwater monitoring, air monitoring, and reporting

Cost to Design and Implement: Design and Planning: $8,000
Implementation (through soil treatment and initial permanganate treatment): $95,000

Cost for Operation and Maintenance: About $3,000/year for vapor recovery system monitoring and analytical costs

Total Costs for Cleanup:

Lessons Learned:

Lessons Learned:

1) Excellent cooperation between Oregon DEQ and property owner resulted in success and environmental benefit. This project could not have been completed without the generous cooperation of the property owner.
2) Ex-situ soil treatment worked very well, and resulted in a significant cost savings because soil was delisted (using contained-in policy) and disposed of as solid waste at a subtitle D landfill instead of being handled as listed hazardous waste.

Contacts:

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(503) 620-7284

Site Specific References:

Site Specific References:

April 11, 2005, Hart Crowser, Interim Remedial Action Measure Report, Springvilla Dry Cleaners, Springfield, Oregon
Project website:
http://www.deq.state.or.us/wr/localprojects/springvilladrycleaners/springvilla.htm

Images:

Images of Site:

Profile last updated on Apr 26, 2005 June 20, 2005